Emerging infectious diseases in Hong Kong

In this issue, Kay et al[1] report the first documented case of new variant Creutzfeldt-Jakob disease (nvCJD) in Hong Kong. The emergence in 1987 of bovine spongiform encephalopathy (BSE) in British cattle[2] followed by the first case of human nvCJD[3] in 1996 ushered in political, economic, and social turbulence that exceeded the absolute amount of morbidity and mortality. Current epidemiological evidence suggests that this case of nvCJD is imported from the United Kingdom, where nvCJD and BSE are endemic. While such cases might seem remote to most local practitioners, this timely episode calls for a reflection on emerging infectious diseases by all medical professionals in Hong Kong.

From an epidemiological viewpoint, the appearance and reappearance of infectious diseases is closely tied to increases in population density, changes in human behaviour and environmental conditions, which are often closely intertwined. For example, global warming and climatic changes (eg El Niño and La Niña) have profound effects on the epidemiology of infectious diseases: changes in the population and distribution of vectors for transmission (eg mosquitoes and Dengue fever, malaria); changes in the population of natural reservoir hosts (eg rodents and hantaviruses, arboviruses, and *Leptospira*); and droughts and floods (eg cholera and other enteric infections). It is estimated that by the end of this century, global warming will enlarge the zone of potential malaria transmission from an area containing 45% of the world's population to an area containing about 60%.[4] Major climatic changes not only have an impact on the zooepidemiology of vectors and infective agents, but the accompanying natural disasters will almost always have a negative public health impact on societies.

Unlike environmental changes, human behaviour is theoretically more amenable to interventions. Behavioural contributions to the epidemiology of infectious diseases can be seen in: sexually transmitted diseases and the AIDS pandemic as a result of the commercial sex trade; enteric infections and outbreaks as a result of improper food handling and consumption habits; zoonotic infections as a result of deforestation and destruction of the natural environment; and acquisition of exotic infections as a result of increasing ease of international travel. In contrast with other metropolitan areas, where zoonotic infections usually occur as a result of occupational or recreational exposure to animals, our unique cultural and religious preference for live poultry results in a significant proportion of the local population being exposed to avian pathogens—most notably the avian influenza viruses—within walking distance in the retail markets. Political conflicts, warfare, and poverty also provide the perfect spawning ground for diseases such as epidemic typhus and trench fever. Yet, history proves that human behaviour often acts in favour of propagation rather than control of infections.

Hong Kong has been in the infectious diseases spotlight on at least three previous occasions. In 1894, a plague epidemic swept Hong Kong and southern China and started the last plague pandemic[5] in which more than 20 million people died worldwide. In the same year, Alexandre Yersin of the Institut Pasteur discovered the bacterium in a Hong Kong Chinese patient dying of plague; this was subsequently named *Yersinia pestis*. In 1969, a new strain of influenza (H3N2 virus—the 'Hong Kong flu') emerged here, heralding the first H3N2 pandemic in recent times and, to this day, replacing the H2N2 virus. In the United States alone, the H3N2 pandemic resulted in an influenza-associated mortality count of at least 33 800.[6] In 1997, the outbreak of avian influenza H5N1 infection again shocked the world, with 18 proven human cases and six fatalities.[7] Significant economic losses were also noted in association with this outbreak. Less shocking, although equally devastating to the local communities affected, are outbreaks of cholera of which the largest outbreak occurred during the severe water shortage years of 1963 and 1964. To date, two of these three common pandemic pathogens, influenza and cholera remain major public health problems in our locality.

Do all these mean that Hong Kong is particularly incompetent in public health management? Definitely not; indeed, the opposite is probably true. Compared with other parts of the world, the health care infrastructure in Hong Kong is fairly sophisticated, including provision of safe food and water, sewage disposal, comprehensive immunisation programmes, accessibility to and quality of health care services, and excellent public health surveillance. The infectious diseases that have plagued Hong Kong probably originated in our neighbourhood. However, the unique and strategic position of Hong Kong in regional and international traffic, together with the quality of our infrastructure, has enabled us to be the first ones to

detect and react to the emergence of new infections which might have gone unnoticed at their point of origin. There are suggestions for an ostrich-like approach to infectious disease surveillence. This, however, must be vehemently resisted: the later an emerging infection is detected, the more difficult it will be to control it, and the more damage it will incur on society's stability and international image, as well as the administration's authority.

With the constant threat of emerging and re-emerging infections, our time-tested armamentarium against infectious diseases—antimicrobial agents and vaccines—may not be as useful in the future as it was in the past. New forms of antimicrobial resistance appear rapidly in microbes as a result of natural mutations and improper use of antimicrobial agents.[8-11] Indeed, this is now considered as one form of emerging infection. Despite major advances in the development of new drugs, we are still faced with a large group of pathogens for which no effective therapeutic agents are available, most notably multi-drug resistant myobacterium tuberculosis, many viruses and prions. The development and use of vaccines has similarly faced numerous hurdles. The majority of bacterial and viral pathogens, as well as all fungi and parasites, are still not preventable by vaccines. New vaccines—such as hepatitis A and varicella vaccines—have been marketed in recent years, although some have had to be withdrawn shortly after introduction due to concerns over their safety. The most recent example of this has been the tetravalent rhesus–human reassortant rotavirus vaccine.[12] Even for time-tested vaccines, serious adverse reactions are constantly being reported and their safety is now being closely scrutinised.[13]

The high expectations of the public and the aforementioned challenges call for new thinking in the surveillance and control of emerging infectious diseases. Early recognition of emerging infections is based on a good surveillance system for infective agents. Conventional human surveillance, however, is restricted in the sense that by the time zoonotic or environmental pathogens have caused a significant amount of disease, preventive programmes could already be too late, or only achievable at great cost. Hence, veterinary and environmental surveillance are crucial adjuncts to human surveillance in a comprehensive surveillance programme. The 1997 outbreak of avian influenza H5N1 infection aptly illustrates this principle: it took 7 months and 18 human cases with six deaths to accumulate enough scientific data to justify the culling of all poultry in the territory. In contrast, the implementation of a very stringent poultry surveillance programme by the Department of Health, Food and Environmental Hygiene, and the Agriculture, Fisheries and Conservation Department enabled poultry-to-human transmission of the avian influenza H5N1 virus to be prevented at a very early stage in May this year. Further refinements in surveillance and the introduction of a monthly chicken-free day throughout the territory are perhaps the most effective alternatives to central slaughtering of all poultry.

Once an emerging infection is anticipated, the success of subsequent prevention and control programmes require a strong political commitment from the government and health authorities. Risk assessment and management should be followed promptly by the drafting of counter-measures. For diseases with pandemic potential, a coordinated international response (including stepping-up of surveillance in other countries and enhancement of vaccine production or drug supply where applicable) must be initiated at an early stage. For the frontline professionals, rapid communication and frequent updates on the disease are possible through easily accessible electronic media (eg the internet). A solid scientific background on infectious diseases is crucial to achieve the aforesaid goals. This requires not only expertise in clinical infectious diseases, but also strong research in basic science. The latter is especially important for newly discovered pathogens or organisms for which no satisfactory diagnostic tests are available. In the 1997 outbreak of avian influenza H5N1 infection, the timely application of molecular techniques, for example, enabled a polymerase chain reaction to be designed within 2 weeks after the onset of the outbreak for rapid diagnosis of H5N1 infections.[7] The knowledge generated from microbial genome projects will offer novel approaches and opportunities in the control of infectious diseases in the future.[14]

Infectious diseases traverse all boundaries—biological and geographical—and Hong Kong has witnessed many pandemic threats over the past 110 years. A stronger and more cohesive effort among all parties—including medical professionals and the public—is needed before the next wave of emerging infectious diseases appears.

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